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EXPERIMENTS
AND
OBSERVATIONS
ON
URINARY AND INTESTINAL
CALCULI.

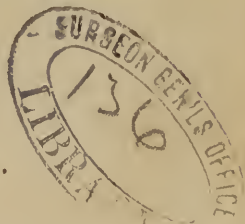
WITH ENGRAVINGS.

BY WILLIAM STEPHEN JACOBS,
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“Whilst so many sages and philosophers, have consumed a long and laborious life in exploring the recesses of the temple of medical science, new discoveries can scarcely be expected from him, who with trembling and uncertain steps, is yet lingering on the threshold.”

I. E. STOCK. *Inaugural Essay.*

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1801.



AN
INAUGURAL ESSAY,
FOR
THE DEGREE
OF
DOCTOR OF MEDICINE;
SUBMITTED TO THE EXAMINATION
OF THE
REV. JOHN EWING, S.S. T. P. PROVOST;
THE
TRUSTEES AND MEDICAL FACULTY
OF THE
UNIVERSITY OF PENNSYLVANIA,
ON THE
EIGHTH DAY OF JUNE, 1801.

INTRODUCTION.

THE author of the following essay can boast of but little more, than having repeated with care, a few experiments long since made by some of the most eminent chemists. In some points of view, his experiments may be seen to differ from those of others but, he presumes that, when taken together they will serve as an evidence of the correctness of some of his experimental predecessors; and that abstractly considered, they may throw some new rays of light on the nature of urinary and intestinal calculi. If the last effect be produced, he can only attribute it to the occasional, yet absolute difference which exists between distinct calculi, and not to any uncommon or superior degree of accuracy in his own experiments. In point of design, he is fully sensible of their insufficiency; but he can assure the reader, that as he had no particular object in view which could bias his

mind, he hopes their result shall have been detailed with candour and integrity.

It may not be deemed altogether uninteresting, to say a few words in this place, concerning the formation of calculi in the animal body, and the manner in which they are said to be affected by medicines internally administered.

The matter of urinary calculus, is properly speaking, a true and natural secretion of the kidneys. The purposes for which this secretion is performed, we are unable even to form a conjecture; of the constituent parts of this matter, the lithic acid of Scheele more properly called by Mr. Fourcroy the *urinic acid*,* is the most conspicuous: It is an acid *sui generis*, and found only in the urinary passages of animals:† of its nature, and habits with other bodies, we are wholly unacquainted. That the secretion of this particular acid, as well as of all the other component parts of calculus, is not a diseased one, is sufficiently proved by the decomposition of

* Dr. Pearson has denied the existence of the lithic acid; he says, it has none of the properties of acids, although this has been fully established by the experiments of Mr. Fourcroy. See his answer to Dr. Pearson, in the 2nd volume of the Philosophical Magazine.

† Dr. Pearson says, he has found it in gouty concretions.

healthy urine,* the products of which, are precisely the same as those of stone. In confirmation of this, we need only recur to a fact familiar to most observers:—I mean the actual formation of calculus upon the walls of privies, and other public places. If the matter of calculus be uniformly and naturally secreted with the urine, how useless and absurd do the voluminous speculations of physicians appear, concerning the supposed influence which lime-water, and other substances have in the generation of stone.

Although urine in general contains most if not all the parts which compose calculus, yet, without the concomitant existence of certain circumstances, it is seldom generated. One of the principal of these conditions, is, what is commonly called a nucleus, or a body upon which, the stone is gradually deposited from the urine. Foreign matters are sometimes known to serve as nuclei for the accretion of stone; and we can readily conceive, and indeed the fact is certainly ascertained, that, when the urine abounds with calculous matter, masses of stone are formed without the presence ^{of} nuclei. In these cases, the quantity of calculous matter, being so

* See the works of Fourcroy and Vauquelin.

abundant, of which we have many histories, upon the highest authority,* it is probable that the urine is unable to hold it all in solution, and, therefore, parts of it are precipitated, which adhere together and in time are consolidated. But the most common kind of nucleus is, we suppose, the coagulable lymph of the blood, which is sometimes effused by inflammation into the pelvis of the kidneys, or the urinary bladder. Two facts render this supposition at least plausible. *First*, from a comparative examination, but few calculi are found containing nuclei. The reason of this is, that,

*The following is the history of a case which came under the care of Dr. Wistar. The friends of a girl, about nine years of age, requested the Doctor's advice concerning a stone in the urinary bladder, the existence of which, the Doctor was satisfied from examination, and soon after extracted it by dividing the urethra towards the vagina. The child in a short time recovered: but some months after, new symptoms of calculus made their appearance. The child would not submit to any further examination this time; during which, small calculi came away daily. I have at least fifty of these calculi, one of which is as large as an hazle nut, of a triangular figure. The patient died last April with a number of stones in the bladder and some, perhaps, in the kidneys. No nuclei were found in any of these stones. A very small quantity of white powder was discovered in many of them, when broke. This state of the system, may be called, with propriety, a *calculous diathesis*.

the coagulable lymph being easily destroyed soon disappears in them. And, *secondly*, the formation of stone is frequently preceded by inflammation, which most commonly attacks the kidneys, in which, calculus, in a majority of cases, perhaps, originates. Were this last fact more generally and more particularly attended to in practice, and the proper remedies for obviating and relieving inflammatory affections of the urinary organs and receptacles administered it is more than probable that many cases of stone might be thereby effectually prevented. But that wonderful and excessive disposition which exists in some habits to secrete the matter of calculus, makes us despair of ever being able to prevent in every case the formation of stone.

The *modus operandi* of medicines, called lithontriptic, has engaged much of the attention and study of physicians for many ages. The afflictive train of symptoms which accompany the stone, is of too serious a kind not to have called forth the tender sympathy and active exertions of humanity to its relief. No condition of human nature is more painful to the body, or more melancholy to the mind of man, than a paroxysm of the stone.—It excites a dismal gloom, to which, all are

strangers but the patient. No state can therefore, more powerfully command the compassionate feelings of a fellow-creature. But after all the labour and attention of physicians, the sufferer derives but partial assistance, and that but seldom, from the use of medicine. He is, for the most part, obliged to pass away a life of misery, or submit to one of the most painful of all surgical operations.

From a candid view of our knowledge concerning the action of lithontriptics, it will appear perhaps, that we are in possession of but little certainty or truth on the subject. It is now even doubtful that medicines are absorbed into the general circulation. If this be the case, to the truth of which, we are not at present disposed to object, what an extensive course of sophistry and train of laboured reasoning is at once destroyed. No subject exhibits a more striking proof of the error that prevails in medical philosophy—the *methodus medendi* at least, than the one before us. Although it may be degrading to the dignity of the medical profession, and even disgusting to the feelings and sentiments of many physicians, it is nevertheless true, that few, if any, are qualified to explain the operation of medicines upon rational—much less,

upon satisfactory principles. If medicines are not absorbed, it would be in vain to administer them with a view of dissolving urinary calculi. But the probability of a certain action of the absorbents, I mean the retrograde motion of their contents, has given a new turn to the investigation. But granting all the force which ingenuity deserves in suggesting this doctrine—not in erecting it, for the aid of fact and experiment is yet wanting on the subject. We presume that our belief in its being groundless is not premature. From a close attention to the natural functions of the absorbents, their structure, as well as from a pathological point of view, we are constrained to declare that no retrograde motion of their contents does take place. The absorbing vessels arise from all the different surfaces and cavities of the body, and terminate in the *thoracic duct*, where their contents are deposited. It is not to be supposed that vessels, such as the lymphatics, which are naturally intended to convey fluids one way, should carry them directly the contrary. Such a tendency as this, would be more effectually prevented in the absorbents than in the veins; which no person supposes suffer their contents to go backwards. The valves of the absor-

bents, like those of the veins, are calculated to suffer the transmission of their contents one way, *viz.* towards the *thoracic duct*, but not the other ; and there existing so great a number of these, is sufficient to shew that nature has been provident to fulfil this wise intention. But in disease, we never observe this retrograde motion—the only affection obvious to our senses, is a want of tone or action in the absorbents. But it is said there are a set of vessels which go from the stomach directly to the bladder, through which, medicines may be conveyed. We know of no such vessels—we never have seen them—we believe no anatomist has, or perhaps ever will be able to demonstrate them ; and the only fact adduced in support of it, which deserves any notice, is the sudden formation of a large quantity of urine in consequence of having taken certain substances into the stomach. This kind of urine, which is called *urina potus* by some gentlemen, possesses but few of the common properties of urine. It is insipid, inodorous, without colour, and resembling water more than any thing else. But we can more readily conceive, of the kidneys forming this kind of urine, than that it passes through a new set of vessels, from the stomach to the

bladder. As it is uncommon, it probably is a diseased secretion ; of which, we know the kidneys, like other glands, are capable. But even admitting that there is a retrograde, or what is sometimes called an inverted peristaltic action of the absorbents, or a direct communication to the bladder, we know that all foreign matters, medicines, for instance, will be changed by the vessels, in their passage through them—consequently, no application can be made of these doctrines to the immediate influence of medicines upon the stone : We therefore believe, that no lithontriptic medicine ever arrives at the bladder, in that state in which it was previously thrown into the stomach.

No. I.

Analysis of a calculus presented to me by Dr. Wistar, who extracted it from the urinary bladder of a child.

This stone was large, rough, and white on the external surface, being grey and more porous towards the center, in which nothing like a nucleus could be discovered. It was irregularly laminated; and the plate which was interposed between the external white and

the internal grey portions of the stone, was harder than any other part, and presented from the surface of its fracture, a great number of small shining points.

Experiment 1.—Forty grains of this stone were boiled on Argand's lamp, in the nitric acid, diluted with distilled water, and in a short time it was entirely dissolved, without effervescence, (a) the residue, after evaporation was of a beautiful rose colour. (b) This residue was freed from the superabundant acid by several washings in distilled water, and successive evaporations; it was afterwards boiled a considerable time in distilled water, in which part of it was dissolved. By adding a few drops of the oxalic acid to some of the clear supernatant liquor, the insoluble part having subsided, a white precipitate (c) was immediately formed.

Experiment 2.—A quantity of the stone being dissolved in the nitric acid, diluted with distilled water, was added to a pure aqueous solution of the acetate of lead, and a copious white precipitate was produced. (d)

Experiment 3.—To a quantity of this solution, the nitrate of silver was added, a copious white precipitate was obtained, (e) but

on adding the muriated barytes to part of the same solution, no change was produced. (f)

Experiment 4.—Two drachms of the same stone powdered were boiled an hour in the caustic vegetable alkali and then filtered, when after examination, twenty-four grains appeared to have been taken up by the alkaline solvent (g)

Experiment 5.—A fragment of this stone was powdered in a mortar, to which I added a piece of the caustic vegetable alkali, and rubbed them together, by which a strong smell of volatile alkali was disengaged. (h)

Experiment 6.—A fragment of the same stone, weighing 24 grains, was exposed in a crucible to a high degree of heat, 30 minutes after it became cool, it assumed a pale blue colour, was unchanged in figure, but had lost in weight 8 grains. (i)

From the above experiments, it therefore appears, that this stone contained no carbonic acid; (a) but the lithic acid (b), as well as lime (c) and the phosphoric acid (d), and the marine acid (e), but no sulphuric acid (f); the presence of one or more acids, is supposed from (g), and the actual existence of volatile alkali from (h), and the existence of mucilaginous as well as of aqueous parts presumed from (i).

*Analysis of a calculus extracted from the urinary bladder of a girl.—It was white, friable, light, irregularly laminated and destitute of nucleus.**

Experiment 1.—Thirty three grains of this stone were dissolved in the nitric acid diluted with distilled water, by the assistance of heat. The solution was attended with effervescence, and a discharge of nitrous gas; it was then evaporated and the superabundant acid thrown off by washing and evaporating, after which some distilled water was poured upon the residue, and suffered to stand. After some time, it was partially dissolved, and to a portion of the clear liquor,

Experiment 2.—I added a few drops of the acetate of lead, and a white precipitate was thereby formed.

Experiment 3.—To some of the same liquor, I added the oxalic acid, which struck a white cloud:

Experiment 4.—To another portion of the same liquor, the muriated barytes was added, but no change was observed.

Experiment 5.—A white precipitate was produced by mixing nitrated silver with some of the same liquor.

* See note page 4.

Experiment 6.—Thirty grains of the same stone were boiled in the same caustic vegetable alkali—a considerable quantity remained undissolved, having filtered it, the clear liquor was saturated with the muriatic acid, and a precipitate of a green colour, was thereby formed. The liquor was of the same colour, likewise, which colour it possessed when discharged from use; this green precipitate was obtained by filtering, and then dried; after which, a portion of it was triturated with some caustic vegetable alkali, but no smell of ammoniac was perceived.

Experiment 7.—The precipitate was partly soluble in alcohol, but more so in water, and imparted a green colour to both.

Experiment 8.—On the remainder of the precipitate, I poured some nitric acid, and a beautiful red colour was instantly produced, and a considerable degree of heat generated. In cooling, a yellow powder was gradually deposited; After this powder had subsided, the red liquor was decanted, and to some of it I added the acetate of lead, by which, a copious precipitation was produced.

Experiment 9.—A beautiful pale red colour, but no precipitate, was formed by ad-

ding some caustic vegetable alkali to some of the same liquor, until it was saturated.

Experiment 10.—The oxalic acid was added to a part of the saturated liquor of the last experiment, but no change was produced.

Experiment 11.—To another portion of the same liquor, the sulphuric acid was added, but no change was observed.

Experiment 12.—To that part of the calculus which was not dissolved in experiment 6, I again added caustic vegetable alkali, and boiled them together; but some remained insoluble. It was filtered, and the liquor which passed through the strainer, was saturated as before with the muriatic acid; the same kind of precipitate was thereby obtained, but no green colour was observed in the liquor. On adding the nitric acid to this green precipitate, when dry, no red colour was formed, as in the former, but it was dissolved.

Experiment 13.—That part which remained undissolved in the last experiment, was treated again in the same manner, and attended with the same phenomena precisely.

Experiment 14.—A few grains of the calculus were triturated with the caustic vegetable alkali, which produced a strong smell of volatile alkali.

We may conclude that the stone, upon which, the last foregoing experiments were performed, did not contain any carbonic acid, the effervescence which was observed in experiment 1. was, probably, only owing to a decomposition of the nitric acid, and not to a disengagement of fixed air; we infer that the phosphoric acid existed from experiments 2 and 8, and lime from experiment 3, although rendered doubtful by experiments 10 and 11. Experiment 4 tends to shew that there existed no sulphuric acid; the existence of the muriatic acid is supposed from experiment 5; experiments 6, 7 and 8, prove the existence of acids; experiment 7, detects a gum-refin; experiments 8 and 9, the lithic and phosphoric acids; experiment 14, detects positively the volatile alkali.

No. III.

Analysis of stones presented to me by Dr. Barton, which were taken from the kidney of a sheep.

These stones which were of a green colour, lamellated, light, brittle, and from the size of an hazlenut, to that of a pin's head; occupied and distended very much, the pelvis

of the kidney. This distension was so great, as to have destroyed the parenchymatous substance of the gland.

Experiment 1.—On forty grains of these stones, I put some nitric acid, and a beautiful deep red colour was instantly formed; and a considerable degree of heat generated; this colour diminished by the addition of water; in cooling, a yellow powder fell to the bottom of the vessel: Besides powder, a brown insoluble matter floated on the liquor; the yellow powder was obtained by filtration, and dried, and upon examination, was found intensely bitter and astringent, as well as entirely soluble in alcohol; it was afterwards precepiated from alcohol, by water; the brown matter which floated on the surface of the fluid, was soluble in water and not in alcohol; it was also soluble in caustic alkali, with which, it formed a brown mixture, but no smell of ammoniac was observed; it was likewise soluble in mild pot-ash, which did not evolve any volatile alkali, but a very fœtid odour.

Some of the red liquor of this experiment, was kept in a vial about three weeks, at the end of which time, the red colour had entirely disappeared.

Experiment 2.—To the above nitric solution, a few drops of the oxalic acid were added, and no alteration was observed.

Experiment 3.—Some of the nitric solution, was saturated with caustic vegetable alkali and acquired a pale red colour, but formed no precipitate. To some of this solution, I added a few drops of the oxalic acid, and the liquor became cloudy.

Experiment 4.—A quantity of vitriolic acid, was added to the saturated solution, and no change ensued.

Experiment 5.—No change was produced by adding separately the alcohol of galls and prussiate of pot-ash to the saturated nitric solution.

Experiment 6.—The acetate of lead, produces a copious white precipitate, in the pure nitric solution.

Experiment 7.—In the saturated solution, no change was produced by the nitrates of silver and mercury.

Experiment 8.—Some of the same stones were boiled in the caustic vegetable alkali; which dissolved them entirely. The colour of the solution was almost black. To a portion of this solution, diluted with rain water,

I added some oxalic acid ; no precipitation took place.

A portion of this caustic solution stood about three weeks in a viol and the colour had entirely disappeared.

Experiment 9.—Some of the alkaline solution was saturated with sulphuric acid, which formed a copious white precipitate.

Experiment 10.—On adding separately the prussiate of pot-ash and alcohol of galls, to separate portions of the alkaline solution, no blue nor black colour was produced.

Experiment 11.—Some of the alkaline solution was saturated by the muriatic acid, which produced a white cloud, which did not subside until several hours had expired.

Experiment 12.—A fragment of the same parcel of stones was placed in a crucible and exposed to a great heat. It instantly swelled up, and a disagreeable odour was dissipated from it. A black coaly matter remained in the crucible.

Experiment 13.—The sulphuric acid, had no action on these stones, without heat : it however dissolved them, when heat was applied, and formed a thick black liquor, resembling common molasses : The muriatic acid, had no action on them.

Experiment 14.—A quantity of these stones were boiled in distilled water for an hour. Nothing seemed dissolved ; when cool, the liquor did not change the colour of litmus paper and no precipitate was observed on cooling.

Conclusions from the foregoing experiments.

Is not the existence of the lithic acid, proved by experiment 1 ? The most sensible proof of which, was the formation of the red colour by the nitric acid ; it stained the skin, wood, ivory, and glass—red ; which is a characteristic mark of the lithic acid. The same colour was obtained from No. 2, but by a different treatment. *See experiment 8, p. 19.* Every author, whose works I have examined, declares that the lithic acid exists only in the human urinary calculus, except Dr. Pearson who found it in gouty concretions.* But we have in this experiment, a strong evidence of its existence in the urinary calculus of a sheep.

It seems probable that a gum resin existed in this stone. The yellow powder which was insoluble in the acid, (in experiment 1), was

* Philosophical Magazine, Vol. II. p. 132.

entirely dissolved in alkohol, and precipitated from it by water, by which circumstance, a resin is distinguished; and the brown matter was, on the other hand, soluble in water and not in alkohol.

Experiment 2, shews that there existed no lime; but experiment 3, is a positive proof of the contrary, and shews that the nitric acid in experiment 2, prevented the combination of the acid of sugar with the calcarious earth. Experiment 4, does not invalidate the above inference; because the sulphuric acid will not always, and does very seldom, form evident crystals of selenite when poured into lime-water. Experiment 8, is an exception to the inference from experiment 3.

Experiments 5 and 10, declare the non-existence of iron. Experiment 6, existence of phosphoric acid.

Experiment 7, non-existence of muriatic acid.

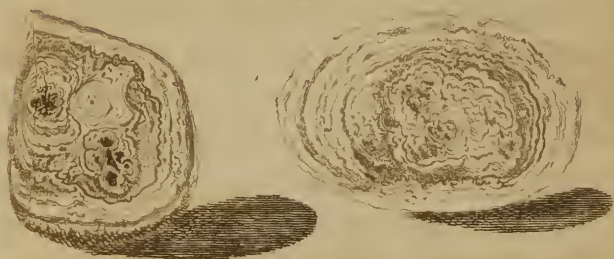
No. IV.

Analysis of an urinary calculus, taken from a woman by Dr. Shippen, the Father of the present Professor.

It was about the size of a pullets egg, of the shape of a heart, depressed on two sides,

the colour in the inside was brown, the next layer was white; which was separated from another layer, which was yellow, by a hard and dark layer. The next layer was of a yellow and brown colour intermixed, and the most external was of a light brown colour, and very easily separated from that with which it was connected. *See Plate I.*

Plate I.

*J. Aikin Esq.*

Experiment 1.—A part of the external layer was dissolved in the nitric acid, as well without, as with the assistance of heat, with effervescence. It was all dissolved and the liquor appeared clear; but after some evaporation it assumed a red colour. This was a proof of the lithic acid.

Experiment 2.—I added to some of this solution some sugar of lead, dissolved in rain water, which produced a white precipitate—a proof of the existence of phosphoric acid.

Experiment 3.—The nitric solution after standing some time deposited large crystals which I could not examine as they were lost by an accident.

Experiment 4.—To another part of this stone, mostly from the inside, I added some nitric acid. By evaporation, this assumed a much redder colour than was observed in the last experiment.* The acid was entirely evaporated and the residue remained very red. Distilled water was then added, which did not alter the colour, but upon adding a few drops of the nitric acid the red colour was completely destroyed and could not be restored by evaporation even to perfect dryness.

Experiment 5.—To some of the clear liquor I added some oxalic acid—it remained unchanged; consequently, there existed no lime.

Experiment 6.—To another portion was added the acetate of lead and a white precipi-

* This shews that the lithic acid, may not only be more abundantly, in one stone than another; but also in different parts of the same stone.

tate was formed. This experiment coincides with the 2nd.

Experiment 7.—16 grains of this stone were exposed to a violent heat in a crucible ; after some time it became black, and took fire ; presenting the appearance of the glow worm. The remainder was nothing but white ashes, weighing only three grains. The loss of weight was owing to the dissipation of aqueous and perhaps of animal or mucilagenous matter.

Experiment 8.—200 grains of this stone were put into a glass tube, hermetically sealed at one end, and coated with a mixture of dung and clay ; the closed extremity was exposed to the heat of Lewis's Furnace, and the other connected with a pneumato-chemical apparatus ; in a short time air was disengaged ; the first two ounce measures I did not examine, as I supposed it was the air of the tube ; the second two ounce measures, being examined by the eudiometer consisted of 60 parts of carbonic acid, and the remaining 40 were nitrogen ; two ounces more came over—this consisted of carbonic acid 10, and of azote 90 ; no inflammable air, or oxigene could be discovered ; the tube was then broken, and the matter examined, which emitted a strong smell

of ammoniac, and a brownish sublimate of an empyreumatic smell, adhered to the sides of the tube.*

Some of the same stone, finely powdered, was put into a very small quantity of nitric acid, and placed upon Argand's lamp, by means of which the acid was soon evaporated. I now added by drops, the same nitric acid, which produced true inflammation, like that of phosphorus; but it was not attended with the crackling noise—white ashes were left behind. This inflammation could be produced at pleasure, by adding the acid.

No. V.

Analysis of a stone taken from the intestines of a horse.

This stone was large, laminated, solid and of a dark colour. *See plate II.*†

* Mr. Fourcroy, has made an experiment somewhat similar, but obtained no gas. *Annal. de Chémie.* Tome. xvi. p. 141. Mr. Hales obtained large quantities of elastic fluid, *Veget. Statics.*

† The horse in whose intestines this stone was found, used to work in a mill, where gypsum was occasionally ground; and the owners were accustomed to feed him on corn, which had been passed through the mill stones, for the purpose of cleaning them; there consequently must have been a large quantity of gypsum mixed with it.

The current opinion was, that the presence of calculi, and the consequent death of the horse, was occasioned by



I. TREATMENT WITH THE MURIATIC ACID.

A quantity of this acid was poured upon one drachm of the stone, pulverized and exposed to the heat of an Argand lamp; in 30 minutes it was all dissolved, without effervescence (a) except three grains which remained at the bottom of the vessel, presenting the

the gypsum. But the following experiments clearly demonstrate, that the formation of the calculus on which I experimented (for seven others, were taken from the same horse) did not depend on the presence of lime.

appearance of mucilage ; this solution, after filtration, was diluted with pump water, and afterwards submitted to the following experiments.

(b) A few grains of the oxalic acid dissolved in pump water, were added to a quantity of the solution, but no change was observed. Upon adding some lime-water, a copious white precipitate was produced.

To another portion of the solution, sulphuric acid was added, but no change ensued.

(c) The muriate of barytes, was added to some of the solution, but no alteration was perceived.

II. TREATMENT WITH THE VITRIOLIC ACID.

Sixty grains of the stone, were exposed an hour, in half an ounce of the sulphuric acid, diluted with two ounces of pump-water, to the heat of Argand's lamp. It was all dissolved, except six grains of black mucilagenous matter, which swam on the surface of the fluid. During the solution, no effervescence (d) was observed. A quantity of this solution was saturated with caustic pot-ash, which formed a white brown precipitate. In this situation it was suffered to remain twelve hours, at the end of which time, a number of crystals (e)

in fine needles were formed, suspended in the mixture.

III. TREATMENT WITH THE NITRIC ACID.

The solution of sixty grains of the same stone in this acid, was attended with the same circumstances which were observed in the two former solutions (f)

A few drops of the muriated barytes were poured upon a quantity of the nitric solution, and no change was observed; but by adding some sulphuric acid, a white cloud was formed (g)

A few drops of the oxalate of pot-ash were added to another portion of the nitric solution, and no change was perceived. To another portion of the solution, sulphuric acid was added, and in like manner no alteration produced (h)

By adding some of the nitrate of silver to some of the solution, a small white precipitate was formed, which resembled exactly that produced by adding some of the nitrate of silver to the nitric acid, part of which, had been used in the solution of the stone, diluted with water (i)

The acetate of lead, dissolved in distilled water, was added to a quantity of the solution;

and a precipitate, as white and as thick as cream, was formed (j)

To a quantity of nitric acid, (part of which had been used in the solution of the stone,) diluted with rain water, I afterwards added some of the acetate of lead, of the same vial as before, but no change resulted from the experiment.

A quantity of the nitric solution was saturated with caustic pot-ash, and a copious brown precipitate was thereby formed. After filtration, the precipitate was dried, and then assumed a yellow colour. This precipitate deliquesced (k) slightly and dissolved with difficulty, and only partially, in cold and boiling water; a quantity of this precipitate was entirely dissolved in the fulphuric acid.

A piece of the intestinal calculus was triturated in a mortar with caustic pot-ash, and a disengagement of ammoniac was smelled (l). The same thing was perceived by triturating the pot-ash with the residue from the evaporation of the nitrous solution of this stone.

A fragment of the same stone, weighing 44 grains, was exposed in a crucible to a high degree of heat. At first it became white; then black; and after some time inflamed, like charcoal: when cool it resumed

the white colour, weighing only 20 grains—was very porous and retained its former figure. It was then boiled a considerable time in water, but was insoluble.

By treating this stone with the nitric acid to detect the lithic acid, no red colour could be obtained. After making a solution of the stone with nitric acid, and saturating it with caustic vegetable alkali, which produced a yellow precipitate, and suffering it to stand several days, I could perceive no crystals except those of nitre, adhering to the side of the vessel.

The same experiment was made on the stone in the muriatic acid, but with a different result. Crystals resembling muriate of soda were obtained.

A part of the stone was partially dissolved in caustic vegetable alkali, filtered and suffered to stand several days, at the end of which time, a number of small crystals were deposited at the bottom of the vessel.

Having pulverized some of the stone, I added to it some mild vegetable alkali, and exposed it to heat in a crucible ; when taken from the fire nitric acid was added to it. A number of red spots were observed at the bottom of the vessel, while the powder was

dissolving. I made the same experiment with this stone without the pot-ash, but could not produce the red spots.

Inferences from the foregoing experiments.

The non-existence of the carbonic acid is clearly ascertained by experiments a. d. & f.

From b & h it appears that there does not exist any lime.

The non-existence of sulphuric acid, as well as the muriatic, is likewise proved by c g and i.

We presume that the existence of animal mucilage is ascertained by the three acid solutions 1, 2, 3.

The existence of the phosphoric acid by j, and of its combination with clay and ammoniac, we have presumptive evidence in e.

The actual existence of ammoniac is positively determined by l.

The crystals in e. were the regenerated calculus; and the precipitate k was the same. Some intestinal calculi are crystallized in needles somewhat resembling the crystals I obtained.

I made the following experiment upon six distinct urinary calculi, taken from different patients, with a view of detecting the lithic

acid. The experiment was performed upon each separately.

The stone being dissolved in the caustic vegetable alkali, and saturated with the muriatic acid, a precipitate was obtained, which was dried; when nitric acid was poured on it, a red colour was formed (the evidence of the lithic acid) in one only of the six: An urinary calculus of a sheep, an urinary calculus of a cow, and the intestinal calculus of a horse were treated in the same way, but no red colour was produced.

To separate portions of distinct human urinary calculi, I added nitric acid, and afterwards evaporated them to dryness; by which, a rose or deep red, colour, was produced in all. An intestinal stone of a horse, and an urinary calculus of a cow were treated in the same manner, but no red colour was produced.

It has been observed above, that this red colour was formed in the sheep's stone by pouring the nitric acid on it immediately; this was the only instance, among all the calculi, in which the red colour could be formed in that manner.

By adding the muriatic and nitric acids to fresh urine, the lithic acid was precipitated after standing some hours in the form of dark

red chrystals. On these crystals, I poured some nitric acid. They were dissolved with effervescence, and the liquor possessed the colour of the acid used.

On the sediment of urine dried, I poured some of the same nitric acid—it likewise effervesced, but did not form a red colour.

No. VI.

*Analysis of a calculus, taken out of the kidney
of a cow.*

Plate III.



J. J. Barrolet del^t



James Aikin sculp^t

This stone was presented to me, by Dr. Mease; it had the figure of a branch of the pelvis, having a protuberance on each side of it; the greater part of the surface, was tuberculated, more particularly, at the extremities;

the external surface of the stone, had, in some places, a metallic appearance, resembling polished gold. On removing the external coat, which was formed of very fine laminæ, the next appeared still more brilliant, and was diffused over the entire surface; on breaking the stone, the laminæ were thin and brittle, resembling mica, and the saw penetrated with greater difficulty than in any other stone I examined: The metallic appearance, was not destroyed by rubbing nitric acid over it, although it effervesced violently. On rubbing some mercurial ointment on it; it became much darker.

Experiment 1.—A part of this stone, was boiled in caustic alkali, by which a large proportion was dissolved; it was suffered to cool and then filtered.

Experiment 2.—To some of this liquor I added, a few drops of the oxalic acid; no change was observed; but on adding some lime water to it, a cloud was produced, which immediately disappeared; this seems to prove that the lime was not taken up by the alkali, as lime was evidently detected by another experiment.

Experiment 3.—Some of this stone, mostly of the internal part, was boiled in nitric

acid ; a violent effervescence ensued ; it was evaporated but no red colour was produced. When it was dry, distilled water was added, till all the acid was thrown off. A large quantity of the stone remained dissolved in the liquor.

Experiment 4.—To a portion of this liquor I added a portion of the oxalic acid ; a white precipitate immediately ensued.

Experiment 5.—To another portion I added some acetate of lead ; no precipitate was observed : but upon adding a drop of the phosphoric acid, a white precipitate was thrown down.

Experiment 6.—To another part, was added the alcohol of galls—no black colour was produced : The same thing was tried with the prussiate of pot-ash, separately, with the same result.

Experiment 7.—With muriated barytes, it formed no precipitate.

Experiment 8.—With the nitrate of mercury, no precipitate was formed ; but on adding one drop of muriatic acid, a copious white precipitate, was obtained.

Experiment 9.—A piece of this stone, was rubbed in a mortar, with caustic vegetable

alkali, by which a strong smell of ammoniac, was produced.

Conclusions from the above experiments.

Experiment 3 evinces the presence of the carbonic, but not the lithic acid.

Experiment 4 proves the existence of lime.

Experiment 5 shews the non-existence of phosphoric acid.

Experiment 6 the non-existence of iron.

Experiment 7 the non-existence of sulphuric acid.

Experiment 8 shews that the muriatic acid, was not present.

Experiment 9 positively proves the existence of ammoniac.

FINIS.

Med. Hist.

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